

Jevons (W. Stanley), F.R.S. *The Principles of Science : a Treatise on Logic and Scientific Method.* 2 vols. 8vo. *London* 1874.

The Author.

Rütimeyer (L.) *Ueber den Bau von Schale und Schädel bei lebenden und fossilen Schildkröten.* 8vo. *Basel* 1873.

The Author.

*March 5, 1874.*

JOSEPH DALTON HOOKER, C.B., President, in the Chair.

In pursuance of the Statutes, the names of the Candidates for election into the Society were read as follows :—

Rev. Alfred Barry, D.D., D.C.L.

Edward Middleton Barry, R.A.

Isaac Lowthian Bell, F.C.S.

George Bishop, F.R.A.S.

W. T. Blanford, F.G.S.

Henry Bowman Brady, F.L.S.

Thomas Lauder Brunton, M.D.

George Buchanan, M.A., M.D.

Walter Lawry Buller, Sc.D.

W. Chimmo, Capt. R.N.

Prof. W. Kingdom Clifford.

Cuthbert Collingwood, M.A., F.L.S.

Herbert Davies, M.D.

August Dupré, Ph.D., F.C.S.

Thomas Fairbairn.

Joseph Fayrer, M.D.

Prof. David Ferrier, M.D.

Peter Le Neve Foster, M.A.

Augustus Wollaston Franks, M.A.

Prof. Thomas Minchin Goodeve,  
M.A.

Lewis Dunbar Brodie Gordon,  
F.G.S.

Robert Baldwin Hayward, M.A.

Prof. Olaus Henrici, Ph.D.

Prescott G. Hewett, F.R.C.S.E.

John Eliot Howard, F.L.S.

Prof. Thomas McKenny Hughes,  
M.A.

Edmund C. Johnson.

Robert M'Lachlan, F.L.S.

Sir Henry Sumner Maine, C.S.I.,  
LL.D.

Richard Henry Major.

William Mayes, Staff-Commander  
R.N.

Charles Meldrum, M.A.

Edmund James Mills, D.Sc.

Richard Norris, M.D.

Oliver Pemberton, M.R.C.S.

Rev. Stephen Joseph Perry.

John Arthur Phillips, F.C.S.

William Overend Priestley, M.D.

William Chandler Roberts, F.C.S.

Henry Wyldbore Rumsey, M.D.

Henry Young Darracott Scott,  
Major-General R.E., C.B.

Alfred R. C. Selwyn (Geol. Survey,  
Canada).

Samuel Sharp, F.G.S.

Robert Swinhoe.

Sir Henry Thompson, F.R.C.S.

Thomas Edward Thorpe, Ph.D.

Charles Todd (Obs., Adelaide).

Edwin T. Truman, M.R.C.S.

Francis Henry Wenham, F.R.M.S.

Wildman Orange Whitehouse, C.E.

Charles William Wilson, Major  
R.E.

Archibald Henry Plantagenet  
Stuart Wortley, Lieut.-Col.

The Presents received were laid on the table, and thanks ordered for them.

The following Paper was read:—

“The Localization of Function in the Brain.” By DAVID FERRIER, M.A., M.D., M.R.C.P., Professor of Forensic Medicine, King’s College, London. Communicated by J. BURDON SANDERSON, M.D., F.R.S., Professor of Practical Physiology in University College. Received February 20, 1874.

(Abstract.)

The chief contents of this paper are the results of an experimental investigation tending to prove that there is a localization of function in special regions of the cerebral hemispheres.

In a former paper published by the author in the ‘West Riding Lunatic Asylum Medical Reports,’ vol. iii. 1873, the results were given of experiments on rabbits, cats, and dogs, made specially for the purpose of testing the theory of Hughlings Jackson, that localized and unilateral epilepsies are caused by irritation or “discharging lesions” of the grey matter of the hemispheres in the region of the corpus striatum. Besides confirming Hughlings Jackson’s views, the author’s researches indicated an exact localization in the hemispheres of centres, or regions, for the carrying out of simple and complex muscular movements of a definite character, and described by him as of a purposive, or expressional, nature.

Facts were also recorded tending to show that other regions of the brain were connected with sensory perception, but no localization was definitely arrived at.

Among the experiments now related are some in further confirmation and extension of those already made on cats, dogs, and rabbits, as well as a new series of experiments on other vertebrates. In particular, numerous experiments on monkeys are described, for the purpose of which the author received a grant of money from the Council of the Royal Society. In addition, the results of experiments on jackals, guineapigs, rats, pigeons, frogs, toads, and fishes are narrated.

The method of investigation consists in the application of the stimulus of an induced current of electricity directly to the surface of the brain in animals rendered only partially insensible during the process of exploration, complete anaesthesia annihilating all reaction. It is supplemented by the method of localized destructive lesions of the hemispheres.

Special attention is called to the precision with which a given result follows stimulation of a definite area—so much so, that when once the brain has been accurately mapped out, the experimenter can predict with certainty the result of stimulation of a given region or centre. The theory that the phenomena are due not to excitation of cortical centres, but to conduction of the electric currents to basal ganglia and motor

tracts, is considered to be disposed of by the fact of the precision and predictable characters of the results, and by the marked differences in the phenomena which are observed when regions in close local relation to each other are excited. Other facts are pointed out bearing in the same direction; among others, the harmony and homology subsisting between the results of experiment in all the different animals.

The experiments on monkeys are first described.

Reference is continually made in the description to figures of the brain, on which are delineated the position and extent of the regions, stimulation of which is followed by constant and definite results. A complete statement of these results in the present abstract is impossible.

Generally, it may be stated that the centres for the movements of the limbs are situated in the convolutions bounding the fissure of Rolando, viz. the ascending parietal convolution with its postero-parietal termination as far back as the parieto-occipital fissure, the ascending frontal, and posterior termination of the superior frontal convolution. Centres for individual movements of the limbs, hands, and feet are differentiated in these convolutions.

Further, in the ascending frontal convolution, on a level with the posterior termination of the middle frontal, are centres for certain facial muscles, *e. g.* the zygomatics &c. At the posterior termination of the inferior frontal convolution and corresponding part of the ascending frontal are the centres for various movements of the mouth and tongue. This is the homologue of "Broca's convolution." At the inferior angle of the intraparietal sulcus is the centre for the platysma.

In the superior frontal convolution, in advance of the centre for certain forward movements of the arm, as well as in the corresponding part of the middle frontal convolution, are areas, stimulation of which causes lateral (crossed) movements of the head and eyes and dilatation of the pupils.

The antero-frontal region, with the inferior frontal and orbital convolutions, give no definite results on irritation. Extirpation of these parts causes a condition resembling dementia.

No results could be ascertained as regards the function of the central lobe or island of Reil.

Irritation of the angular gyrus (*pli courbe*) causes certain movements of the eyeballs and pupils. Destruction of this convolution gives data for regarding it as the cerebral expansion of the optic nerve, and, as such, the seat of visual perception.

The phenomena resulting from irritation of the superior temporo-sphenoidal convolution (pricking of the ear, &c.) are indications of excitation of ideas of sound. It is regarded as the cerebral termination of the auditory nerve. The sense of smell is localized in the uncinate convolution. The situation of the regions connected with sensations of taste and touch is not accurately defined, but some facts are given indicating their probable locality.

The occipital lobes do not react on stimulation. Destruction of these lobes caused no loss of sensation or voluntary motion, but an apparent abolition of the instincts of self-preservation.

The corpora striata are shown to be motor in function, and the optic thalami sensory.

Stimulation of the corpora quadrigemina causes dilatation of the pupils, opisthotonic contractions, and the utterance of peculiar cries when the *testes* alone are irritated. The nature and signification of these phenomena are regarded as still obscure, and requiring further investigation.

Some experiments have been made on the cerebellum of monkeys. They confirm the author's previous views as to the relation of this organ to coordination of the optic axes, and the maintenance of bodily equilibrium. The experiments are not detailed, as they will form the subject of a future paper.

New experiments on dogs essentially confirm those already published, while many new facts have been elicited. Those on jackals agree in the main with the experiments on dogs, both as to the character of the results and the localization of the centres. New experiments on cats generally confirm, as well as further define, the results described by the author in his former paper. The facts of experiment on rabbits, guineapigs, and rats are essentially alike, and also confirm former statements.

In all those animals the sensory regions are defined and their position compared with those in the brain of the monkey.

The only result obtained by stimulation of the cerebral hemispheres in pigeons was contraction of the pupil. The region associated with this action, situated in the postero-parietal aspect, is compared with a similar region in the mammalian brain, and regarded as the seat of visual perception.

Movements of the limbs in frogs, and of the tail and fins in fishes (as in swimming), can be excited from the cerebral hemispheres in these animals. Exact localization of motor and sensory centres is not possible.

The optic lobes in birds, frogs, and fishes seem related to movements of flight and progression, in addition to their relation with the eyes. Similar phenomena result from irritation of the cerebellum; but the signification of these is reserved for future inquiry.

From the data of physiological experiment a foundation is obtained for constructing an anatomical homology of the convolutions.

Among other points in homology the fissure of Rolando is shown to be the homologue of the crucial sulcus in the brain of the Carnivora.

The whole brain is regarded as divided into sensory and motor regions, corresponding to the anatomical relation of these regions to the optic thalami and corpora striata and the sensory and motor tracts.

The motor regions are regarded as essential for the execution of voluntary movements, and as the seat of a corresponding motor memory

motor ideas), the sensory regions being looked upon as the organic seat of ideas derived from sensory impressions. An explanation is attempted of the phenomena of aphasia, and the relation of the memory of words to the ideas they represent.

The theory that a certain action, excited by stimulation of a certain centre, is the result of a mental conception is considered and disputed. From the complexity of mental phenomena, and the participation in them of both motor and sensory substrata, any system of localization of mental faculties which does not take both factors into account must be radically false. A scientific phrenology is regarded as possible.

The paper concludes with a short consideration of the relation of the basal ganglia to the hemispheres. The view is adopted that they constitute a subvoluntary or automatic sensori-motor mechanism.

*March 12, 1874.*

JOSEPH DALTON HOOKER, C.B., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

- I. "Contributions to the Developmental History of the Mollusca. Sections I., II., III., IV." By E. RAY LANKESTER, M.A., Fellow of Exeter College, Oxford. Communicated by G. ROLLESTON, M.D., F.R.S., Linacre Professor of Anatomy and Physiology in the University of Oxford. Received January 19, 1874.

(Abstract.)

Section I. *The ovarian Egg and early development of Loligo.*

The points of greatest interest to which the author draws attention in the present memoir are :—

1. The explanation of the basketwork structure of the surface of the ovarian egg by the plication of the inner egg-capsule.
2. The increase of the yolk by the inception of cells proliferated from the inner egg-capsule.
3. The homogeneous condition of the egg at fertilization.
4. The limitation of yolk-cleavage to the cleavage-patch.
5. The occurrence of independently formed corpuscles (the autoplasts) which take part in the formation of the blastoderm.
6. The primitive eye-chamber, formed by the rising up of an oval wall and its growing together so as to form a roof to the chamber.
7. The origin of the otocysts by invagination.
8. The rhythmic contractility of a part of the wall of the yolk-sac.